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ABSTRACT

The fourth goal in the 1989 "Curriculum and Evaluation Standards for School Mathematics" by the National Council of Teachers of Mathematics (NCTM) is for students to learn to communicate mathematically. The call for this implies that students should be given opportunities to use all communication vehicles available. Writing journals is a vehicle for communication that mathematics teachers can easily integrate in their classrooms thereby helping students not only to learn but also aid the development of their mathematical communication skills. It is the position of this paper to support the premise that writing stimulates and enhances learning. The use of writing journals in the mathematics classroom will help students learn to communicate mathematically and provide a medium in which to use mathematical terminology for explaining concepts and applications thereby developing and clarifying their understanding. Students are not the only ones to profit from writing journals, as indicated by experts, writing journals can also be an instructional tool for teachers. Contains 19 references. (Author/NB)

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Abstract

USING WRITING JOURNALS IN THE MATHEMATICS CLASS

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The fourth goal in the 1989 Curriculum and Evaluation Standards for School Mathematics, by the National Council of Teachers of Mathematics (NCTM), is for students to learn to communicate mathematically. The call implies that students should be given opportunities to use all communication vehicles available. Writing journals is a vehicle for communication that mathematics teachers can easily integrate in their classroom, thereby helping students to not only learn but also aid the development of their mathematical communication skills.

It is the position of this paper to support the premise that writing stimulates and enhances learning. Further, the use of writing journals in the mathematics classroom will help students learn to communicate mathematically. Writing journals give students a medium in which to use mathematical terminology for explaining concepts and applications and thereby, developing and clarifying their understanding of the concepts and applications. And finally, writing journals is an instructional tool for teachers.

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USING WRITING JOURNALS IN THE MATHEMATICS CLASS

The integration of language arts and mathematics is not a new idea to those who teach both of these subjects; however, when a teacher teaches more than one subject, each subject tends to get compartmentalized. While this may be true, many teachers of content areas such as mathematics, science, art, social studies, and music are discovering that teaching reading and writing in their classrooms, particularly with the use of writing journals, is important in that it helps their students to learn and develop their language skills. According to Yellin and Blake (1994), teachers are reporting that students are learning and retaining more information when they are being asked to write in the content areas. For example, Dusterhoff (1995) reported that she saw writing as "a multipurpose tool which communicates and increases understanding in all content areas while providing meaningful assessment information on which to base future instruction" (p. 49). However, the subject area least studied and embraced in the inclusion of writing across the content areas, specifically the use of writing journals, has been mathematics. Notwithstanding, since "writing increases learning and as such must not be limited to the language arts classroom" (Dusterhoff, p. 49).

The terms language arts and reading and writing will be used interchangeably because language arts' curriculum, as a discipline, is comprised of reading, writing, speaking, and listening. Academic success in all subjects mandates an ability to read, write, speak, and listen effectively and efficiently. The praxis of language arts provides

the medium in which all communication skills are developed. Consequently, language arts serves as an impetus for learning in all subjects, by providing the basic skills which are essential to learning. Hence, it would stand to reason that mathematics is no exception to this premise.

Writing Journals Defined

Writing journals generally refer to a compilation of entries that can serve many different purposes. Teachers generally use journals to give students a medium in which students can develop a sense of responsibility for and independence in learning. Journal entry formats range from focused or unfocused diary-like entries to teacher-directed reflections on specific lessons, concepts, or problems. Students could also be required to maintain a vocabulary journal much like the vocabulary journals kept in the reading classroom.

Background

The fourth goal listed in the 1989 Curriculum and Evaluation Standards for School Mathematics, published by the National Council of Teachers of Mathematics (NCTM), is for students to learn to communicate mathematically. This NCTM recommendation calls for increased attention to "student communication of mathematical ideas orally and in writing" (p. 129). Oral speech has held its position as the most common form of communication in the mathematics classroom (Dougherty, 1996). Students are often asked to orally explain or discuss their understanding of

concepts or problems. Be that as it may, Dougherty (1996) reminds us that oral speech does not require the same elaboration as writing. Educators have been using writing journals in various subject areas for decades in elementary, secondary, and post-secondary schools. However, they rarely use writing journals in mathematics classes. An integration of the mathematics and language arts curricula would best fulfill the NCTM recommendation and may be most effective with the use of writing journals.

It is explained by DeVito, Krockover, and Steele (1993) that if there were a hierarchy of subject areas, traditionally reading and language arts would occupy the top position and "that these two areas must infiltrate all instruction" (p. 52). They further assert that we should take every opportunity to promote better reading and language arts skills because reading is at the hub of learning. They further propose that one does not read without reading about something and that other areas of the curriculum are supported by that something.

Reading is traditionally taught in the reading class and writing is taught in the English class. Reading and writing not only has been taught separately from each other, but have been taught separately from other subjects as well. Reading and writing go hand-in-hand. Reading and writing are the most important tools for learning. They ease the acquisition of knowledge and serve as a medium to find ideas. Writing like reading is also a tool for thinking. It is a vehicle for sorting out and clarifying thoughts. Writing gives students an opportunity to crystallize their best thoughts and bring order and development to their thinking.

Language skills are as important in the mathematics class as they are in other

content areas. This becomes most apparent when educators require students to take tests—especially standardized tests, which by their nature, place great importance on language skills. Therefore, a student who is an inadequate reader and has poor mastery of vocabulary is at a serious disadvantage in a testing environment. Thus, a language deficiency will clearly lead to a mathematical deficiency (Davison, 1989). Yet, Mayer and Hillman (1996) discovered that journals afford students, who typically do not test well, the chance to realize success through revision of prior work and the opportunity to document evidence of growth. Their "students receive constructive feedback and are able to improve their communication skills and increase their understanding of mathematical concepts" (p. 432).

The effective teaching of mathematics requires an emphasis on the development of students' abilities to express themselves clearly in both oral and written work. The conclusions of Kennedy, Litwill, and Nichols (1992) in their summary of the NCTM's standards for teaching mathematics is that precise and accurate communication about mathematics is closely connected to doing precise and accurate mathematics. This is evidenced in the findings of Mayer and Hillman when they reported that students, through their writing, were often able to pinpoint their difficulties and tended to ask more precise questions in class rather than saying "I don't get it" (p. 430).

Writing as Meaningful Learning

It has been concluded that writing causes students to be more involved in learning and forces them to understand concepts more completely. Also, writing can

help students to learn content material. Writing can be used in several different ways to make learning meaningful. Writing is an individual process; it gives students an occasion to let people know what they are thinking, and it helps them to understand themselves. Through writing many students get ready for reading and learning, then they can use writing to respond to what they have read and to link or summarize all the information that they have acquired. For students, the curriculum can become a cycle of writing, reading, thinking, and then more writing to reflect upon and extend their thinking (Yellin & Blake, 1994). Many students traverse through educational institutions without a clear understanding of basic mathematical concepts, theories, and vocabulary. Further, students cannot or do not use mathematical terminology to express themselves or to explain their methodology in problem solving. These mathematical and communication deficiencies are a constant source of frustration to teachers. One of the reasons for this dilemma could be that teachers of mathematics often trivialized the integration of language arts in their classrooms; therefore, not heeding the NCTM's call for students to learn to communicate mathematically. The call clearly implies that students should be given every opportunity to use all communication vehicles available. Writing journals can be a vehicle for communication that mathematics teachers can easily integrate in their classrooms, thereby helping students to not only learn but also aid the development of their mathematical communication skills

To promote reading and writing skills in the mathematics class, students need opportunities to communicate. In the mathematics classroom, activities that require

communication will help students to clarify, refine, and organize their thoughts (Burns, 1995). According the Daviau (1993) writing is a way of thinking and thinking is an integral part of the mathematics curriculum. Additionally, by teaching our students how to organize their ideas through writing, actively reading for understanding, and writing to learn content, our students will become more independent. Such activities will also help students' facility with mathematical language. Integration of writing across the curriculum establishes a clear purpose for learning. It legitimizes the content of the curriculum and gives students a reason for getting information.

Within an integrated curriculum, teachers need to be concerned with helping students to develop certain comprehension and communication competencies (Yellin & Blake, 1994). The problems that students have in learning and language expression should be a motive for the integration of language arts and mathematics. Understanding and effectively using the specific vocabularies of the various subject areas is one. Successfully getting math content information depends on the ability to understand a wide range of concepts, and understanding those concepts is dependent on being familiar with the specific or technical vocabulary of the subject. Therefore, to obtain information from the curriculum, students need to have extensive word knowledge and to be aware of the strategic links between specialized content vocabularies and their underlying concepts. Unfortunately, many students have a good listening and speaking vocabulary that far exceeds their reading and writing ability (Suter, 1990). Summarily, (Greenes, Schulman, & Spungin, 1992) communication is enhanced by understanding and conversely, understanding is enhanced by

communication. The degree of understanding; of a concept or idea is intimately related to the successful communication of that concept or idea.

The NCTM's call for students to learn to communicate mathematically suggests that they should communicate mathematics in writing, since writing promotes meaningful learning. Historically, students have made oral presentations in the mathematics class; teachers have always had students present their work on the blackboard and explain their understanding of a particular concept. And the value of those presentations is appreciated, however, oration is only one form of communication, not without limitations for thinking. Writing, on the other hand demands that ideas must be treated with more depth because the reader cannot reconstruct the author's intentions. Writing creates a context in which students must integrate concepts to communicate their ideas (Elliott, 1996).

In Thought and Language (1962), Vygotsky notes that "written speech is a separate linguistic function, differing from oral speech in both structure and mode of functioning" (p. 98). Some of the differences between writing and speaking are that writing is learned behavior, whereas talking is natural; writing is an artificial process, when talking is not; most writing is slower than talking, and writing usually results in a visible graphic product, while talking does not (Emig 1988). To encapsulate these differences, writing can be seen as a representation of the world made visible, embodying both process and product, accordingly writing is more a form and source of learning than talking. Emig further explains that writing represents a unique mode of learning, serving learning uniquely because, as process and product, writing possess a

cluster of attributes that correspond to certain learning strategies. She strongly suggests that writing be heuristic, in that it serves as an aid to learning, discovering, and problem solving.

Writing journals can have a positive effect on the development of communication skills and mathematical understanding. This is exemplified in the report of Haven (1989) in which she says that:

> For these students who had failed under traditional methods of teaching mathematics for nine or ten years in a row, writing in mathematics gave learning a new dimension. It forced them to understand and to apply a concept instead of just having to remember the "trick" to each operation. My students not only improved their mathematical abilities, but they expanded their abilities to understand difficult concepts and communicate this understanding to others. (p. 152)

Benefits for Teachers and Students

Journal writing can be beneficial to both teachers and students. First for teachers, journal entries can provide a window to students' thinking processes. Secondly, journals can give teachers firsthand information from individual students and the keys and clues they need to assess learning. And finally, the information gleaned from students' journals can give teachers the feedback and guidance they need to either correct instruction or redirect their instruction (Moffet & Wagner, 1993).

One benefit to students is that writing forces them to engage their thoughts

metacognitively. Koehler (1994) explains that the cognitive processes are used to acquire knowledge and metacognition is the process of thinking about thought. The cognitive processes involve analysis, transformation, and the integration of information, whereas metacognitive processes involves development of an awareness of how we go about thinking and solving problems—the conscious control we have of our own thought processes. To engage ideas actively and substantively and write about them requires cognition and metacognition. Journal writing creates an arena for students to incubate their thoughts, thereby facilitating their metacognitive processes. Other benefits of journal writing for students is that it will help them to communicate about mathematics and to sort, clarify and address questions that they may have about the subject. Journal entries will give students an opportunity to communicate with their teacher in private and, therefore, receive individualized attention.

There are several different proposals for the effective use of writing journals in the mathematics class. Since writing journals serve many different purposes, the desired results is contingent upon the teacher's stated purpose. It is agreed from the literature that students should be apprised of the purpose for their maintaining a journal and initially, they should be directed in their entries. Menon (1994) states it best when she says that, ". . . journal writing is the promotion of, and commitment to, mathematical learning, rather than just the use of the journal as an emotional catharsis, or a place to simply write down anything, probably unconnected to mathematical learning" (p. 18).

It is recommended that students keep a content journal (Daviau, 1993). It is further recommended that journals be informal and non-graded concentrating on

personal reflections. The suggested use for journals can be to solve problems, answer questions, write problems, express opinions, summarize ideas, record daily work, brainstorm ideas about content, or clarify questions. The consensus is that writing journals in the mathematics classroom will give students a vehicle by which to use their own experiences and language to give autonomy and ownership to their learning (Menon, 1994; Sensenbaugh, 1992) Sensenbaugh summarizes that "the purpose of journal writing is to help students clarify their thinking and learn the subject better by working through the difficult material. Unless students stick to using journals to sort out their ideas, journal writing can easily degenerate into an exercise in filling up paper with random thoughts, or into an exercise in trying to impress the teacher" (p. 7).

Conclusion

Writing across the curriculum supporters often advocate that the integration of writing in the subject areas not generally associated with writing should aid in developing students' writing not only for the sake of having them to write but also to have them write better. This concept would naturally include writing remediation. Writing across the curriculum is being implemented in many educational institutions. Writing serves a dual purpose, first journal writing in the mathematics class provides a means and opportunity for students to write and second, writing helps students to learn better and by writing more, students improve their writing.

For years, the NCTM and researchers have been calling for students to

communicate mathematically. Writing journals provide both means and opportunities for students to write, thereby communicating in the mathematics classroom. The most significant advantage or benefit of the integration of language arts and mathematics is the higher-order thinking required in journal writing. Just as students in other content areas have benefited from the integration of writing journals, mathematics students should be given the same benefits. Finally and most importantly, students are not the only ones to profit from writing journals, as indicated by the experts, writing journals can be an instructional tool for teachers.

References

Burns, M. (1995, April). Writing in math class? Absolutely. Instructor, 104 (7), 40-47.

Daviau, K. (1993). Reading and writing across the curriculum. (ERIC Document Reproduction Service No. ED 362 672).

Davison, D. M. (1989). An ethnomathematic approach to teaching language minority students.(ERIC Document Reproduction Service No. ED 354 776).

DeVito, A., Krockover, G. H., & Steele, K. J. (1993). Creative teaching: a practical approach. New York: HarperCollins College Publishers.

Dougherty, B. J. (1996, October). The write way: A look at journal writing in first-year algebra. The Mathematics Teacher, 89 (7), 556-560.

Dusterhoff, M. (1995, January). Why write in mathematics? Teaching K-8, 48-49.

Emig, J. (1988). Writing as a mode of learning. In The writing teacher's sourcebook. Tate, G. & Corbett, E. (Eds.). New York: Oxford University Press.

Greenes, C., Schulman, L., & Spungin, R. (1992, October). Stimulating communication in mathematics. Arithmetic Teacher, 40 (7), 78-82.

Havens, L. (1989, October). Writing to enhance learning in general mathematics. Mathematics Teacher, 82 (7), 151-154.

Kennedy, P. A., Litwiller, B. H., & Nichols, E. D. (1992). Holt Pre-Algebra annotated teacher's edition. Austin, TX: Holt Rhinehart and Winston, Inc.

Koehler, S. (1994, Spring). What is critical thinking. Adult Education Connection, 6, 1-4.

Mayer, J. & Hillman, S. (1996, May). Assessing students' thinking though writing. The Mathematics Teacher, 89 (5), 428-432.

Menon, R. (1994, June). Using mathematics journals more effectively. Mathematics Teaching, 147, 18-19.

Moffett, J. & Wagner, B. J. (1993, January). What works is play. Language Arts, 70, 32-42.

National Council of Teachers of Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: Author.

Sensenbaugh, R. (1992). Using language to learn science and math. (ERIC Document No. ED 347 518).

Suter, A. D. (1990). Discovering basic math concepts: Teacher's resource guide. Chicago: Contemporary Books, Inc.

Vygotsky, L. S. (1962). Thought and language. (E. Hansfmann & G. Vakar, Trans.). Cambridge, MA: MIT Press.

Yellin, D. & Blake, M. (1994). Integrating the language arts: A holistic approach. New York: HarperCollins College Publishers.